

# Partnerships in Sustainability: Rail Tunnel Adaptation for Transit, Pedestrians and Bicyclists

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## INTRODUCTION

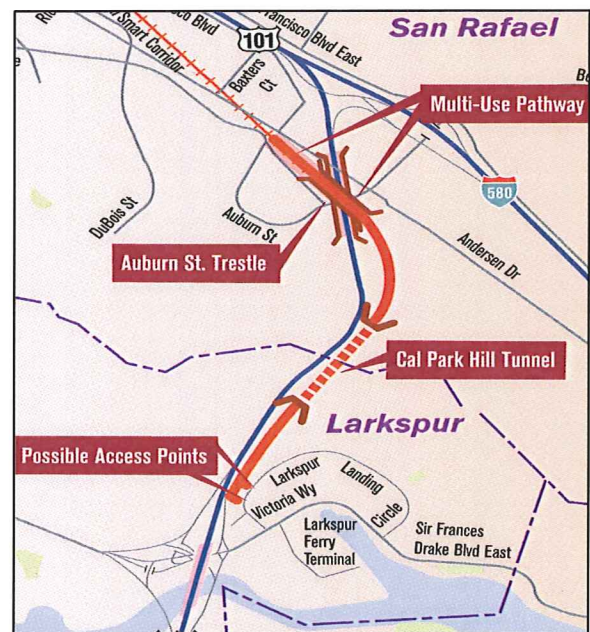
Scheduled to begin construction in July 2008, the Cal Park Hill Tunnel Rehabilitation and Pathway project is taking shape as a model public works project in terms of sustainability, shared vision, local partnership, and good long term planning. Providing a crucial transportation link between the cities of San Rafael and Larkspur in Marin County, the Class I multiuse pathway following the existing partially abandoned and out of service railroad right-of-way and through the historic tunnel will overcome a formidable obstacle for commuting and recreational cyclists: Cal Park Hill, which rises 200' above the coastal plain and has traditionally been a barrier between central and southern portions of the county for other than motorized transportation modes. No alternative routes exist for those wanting to abandon their cars, other than a strenuous climb, or long detours with hazardous roadway crossings,

The project will connect two major public transportation facilities: the Bettini Transit Center in San Rafael, a major hub for inter- and intracounty bus service, and the Larkspur Ferry Terminal. Both terminals are operated by the Golden Gate Bridge, Highway and Transportation District, or GGBHTD (the same agency which administers and operates the Golden Gate Bridge). 40 ferries a day ply the waters between Larkspur and San Francisco's Ferry Terminal, making this by far the most heavily used of the Bay Area's ferry services.

With the rehabilitated 1,100-foot Cal Park Hill tunnel as its centerpiece, the 1-mile long pathway will also close a crucial gap in the long-planned north-south "greenway" through Marin and Sonoma Counties. This greenway would provide a new recreational and commuting mode for the many cyclists and pedestrians in the corridor that

parallels busy Highway 101, the famous "Redwood Highway".

Figure 1. Project Map.



The County of Marin Department of Public Works is the project's implementing agency. The County chose a team led by engineering consultant Earth Tech to help plan, design and manage the public and stakeholder process for this unique and challenging project.

Challenges have been numerous on both a technical and institutional level. One partnership that has been key to this project's success has been with Sonoma Marin Area Rail Transit District (SMART), owners of the right-of-way and the agency planning the future commuter rail service in the presently defunct railroad corridor. As a

result, the multiuse pathway is taking shape for delivery to the public in 2009, the first of its kind "rail tunnel with trail" in the United States, and an icon of sustainability and environmental stewardship.

During preliminary engineering, local voters overwhelmingly approved a countywide transportation sales tax measure, along with creation of a new planning agency, the Transportation Authority of Marin (TAM). Besides administering the tax, TAM's function is to run the county's Congestion Management Agency (CMA). The CMA programs state and federal discretionary funds and monitors project delivery and system performance

TAM implements other programs in the County to strengthen the connection between land use and transportation decision-making, including Regional Measure 2 (RM 2). Due to the complex funding strategies required to design and construct the Cal Park Hill project, TAM has become a co-sponsor for the project, assisting the County and SMART with securing and implementing the multiple fund sources.

## **CONTEXT AND BACKGROUND**

### **History of Railroad Use**

Railroad service in the 300-mile long Northwestern Pacific corridor dates from the 1800's, initiated to accommodate passenger and freight rail traffic between San Francisco and coastal Northern California and the Redwood Empire. In 1907 the Northwestern Pacific Railroad (NWPRR) was formed as a partnership of two major railroads, the Southern Pacific Railroad (SPRR) and the Atchison, Topeka and Santa Fe Railway (Santa Fe) to consolidate and streamline operations<sup>1</sup>. The NWPRR ran from Tiburon, along the shores of the San Francisco Bay to Eureka, in remote Humboldt County. In Tiburon, those continuing south to San Francisco could make the crossing by ferry in 20 minutes.

The NWPRR is notable for running the first electrified 3rd rail "interurban" train in California, operated in Marin County from 1902 until 1941. Beginning with the opening of the Golden Gate Bridge in 1937, commuters began migrating from train-ferry service to commuting by car and bus, cutting into the railroad's business.

Through the early 1960's the line continued operating as far south as Sausalito and the downtown Tiburon rail

yard, where box cars were loaded on barges. Freight operations continued through NWPRR Tunnel No. 3 (i.e. the Cal Park Hill Tunnel) during the 1960's and 1970's, serving local shippers including a rail car restoration business and quarry in Larkspur. In 1985, the NWPRR ended all service south of San Rafael. The last train to use the tunnel was probably in 1985. Its last customer, Handicap Corporation in Corte Madera, is still in business today.

The original Cal Park Hill Tunnel dates from the 1880's. Due to heavy usage, the tunnel was re-excavated in 1924 to allow for two tracks, making it the only double-track tunnel built along the entire NWP corridor.

### **Public Ownership**

As rail traffic in the North Bay diminished, rail infrastructure fell into disrepair. Fortunately, in the 1970s the Marin County portion of the corridor was purchased by a Joint Powers Agency consisting of the Golden Gate Bridge, Highway and Transportation District, County of Marin and Marin County Transit District, in order to preserve the corridor for public transportation purposes.

In the late 1980's, deterioration of the Cal Park Hill Tunnel's wood lining resulted in a partial collapse near the south portal. A subsequent fire in 1990 extended the collapse area. To stop the fire, crews plugged the portal and sinkhole with earth fill. Repair work to address less severe collapses occurred in the 1990's.

### **Preparing for Commuter Rail**

SMART was created in 2002 through state legislation, to oversee the development and implementation of commuter rail service in Sonoma and Marin Counties. SMART controls over seventy miles of publicly-owned railroad right-of-way once owned by the Northwestern Pacific Railroad (NWP). 14 stations are planned, nine in Sonoma County and five in Marin County.

SMART has obtained environmental certification through the California Environmental Quality Act (CEQA). The determination has not been challenged by opposition groups. Currently, supplemental environmental review is underway in preparation for a sales tax measure planned for the November 2008 ballot, which would fund final design and construction of the rail system.



## CORRIDOR DESCRIPTION

### The Highway 101 Corridor

Southbound Highway 101 through Marin and Sonoma Counties is the fourth most congested commute in the San Francisco Bay Area during the AM peak period. Hilly terrain and historic growth patterns have resulted in linear development along first the railroad, then the highway that paralleled it. With no highway alternatives, the result is a heavily populated 50-mile plus stretch of development between Sausalito and Santa Rosa. As the major gateway to northern California and the Pacific Northwest, the corridor also receives a great deal of recreational and non-commute traffic, particularly on summer weekends.

This constrained growth combined with environmental restrictions has severely strained the lone transportation facility, only two lanes wide in critical locations. Compounding the problem are demographic differences between slow-growth Marin County on the south, and neighboring Sonoma County to the north. The latter has increasingly become a “bedroom” county of the Bay Area as home prices in Marin County and San Francisco have skyrocketed. The result is a southbound AM commute that can regularly consume 90 minutes from Santa Rosa to San Rafael, a distance of 40 miles.

### Recent Congestion Trends

Most recently, the nature of congestion in the region has assumed additional characteristics. Marin County showed little population growth over the past decade (about 3%), reflecting limited availability of land for residential development. Employment and trip growth however, exceeded 8% and 10% respectively. This trend reflects more in-county jobs, and more local trips made for both work and non-work purposes. In fact, over 50% of work trips never leave Marin County, dispelling the once-held notion of Marin County as a “bedroom” community of San Francisco.

Local congestion in the US101 corridor has taken on a regional component. Marin County has emerged as a regional center for workers from the North Bay and East Bay. In addition, 79% of Marin residents’ trips are within the county, making them a key component of congestion. With the problem causes identified, local officials were able to articulate a common goal – to improve mobility and reduce local congestion for everyone who lives or

works in Marin County through a variety of high quality transportation options designed to meet local needs.

### A Push for Intermodal Connectivity

By the year 2000, both regional and local funding sources were being put in place to begin implementing the long list of multimodal projects needed to address the problem. Investments that filled critical “gaps” in the system were given high priority. Projects that offered a high degree of intermodal connectivity (bus, ferry, future rail) were favored. A safe network of pedestrian pathways was also seen as crucial, due to the expected high usage by schoolchildren, cyclists, seniors and other user groups.

Efficiencies in both process and results are already evident. Both Marin and Sonoma Counties have created single-purpose transportation authorities to guide planning and implementation of local and regional transportation projects. Voters can take credit for adopting local tax measures that have transformed both counties into “self-help” counties, allowing them to leverage local funding with significant non-local contributions. Other successfully adopted regional and local tax measures have also helped.

*Figure 2. Connections to important regional modes will be enhanced.*



The Cal Park Hill project is a critical link in a much broader strategy of a multimodal network taking shape in southern and central Marin County. The importance of the two major public transportation terminals, one at each end of the project cannot be overstated, nor can the interrelationship with the future SMART commuter rail system. A sampling of other related projects now in advanced planning follows.

### **Highway 101/Greenbrae Corridor Project**

The Greenbrae Corridor project is a major piece of the North Bay's transportation blueprint. Now in environmental planning, it consists of a package of multimodal improvements intended to reduce congestion and enhance safety in the Corte Madera-Larkspur-Greenbrae "corridor", while enhancing regional connectivity. Due to the lack of parallel arterials, Highway 101 has evolved into "main street" serving both local trips as well as regional traffic.

A centerpiece of the Greenbrae Corridor project is the Central Marin Ferry Connection (CMFC), a new multi-use path that would extend the Cal Park Hill pathway to the south, over Sir Frances Drake Blvd. and Corte Madera Creek, increasing the "catchment" area for bicycle-to-ferry commuters into Larkspur and Corte Madera. This would also, of course, be another important component of the planned North-South Greenway.

### **Connections in San Rafael**

The California Department of Transportation (Caltrans), TAM and the City of San Rafael are constructing a new, 1.2-mile multiuse pathway between downtown and the Marin County Civic Center, as part of a HOV gap closure project for Highway 101. The City has also secured funding for design and construction of two multiuse pathway projects that would complete the challenging "last mile" linkages through heavily trafficked downtown San Rafael with the Bus Transit Center while providing a connection to the northern end of the Cal Park Hill Project. All of these are subcomponents of the planned North-South Greenway.

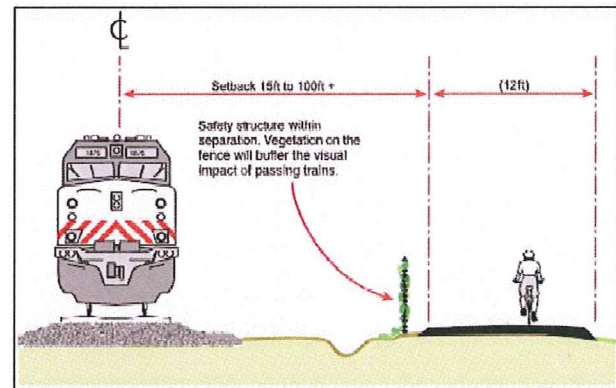
### **Sharing with Future Commuter Rail**

An important component of the SMART project is the combination Class 1 and Class 2 bicycle-pedestrian pathway that will run along most of the SMART right-of-way. At an estimated cost of \$80.4 million, both SMART and local communities along the corridor have made a significant commitment to both rail *and* trail. The Marin and Sonoma County Bicycle Coalitions were both instrumental in helping determine the alignment of the pathway.

Initially SMART staff worked with these groups, and later with a dedicated Bicycle Pedestrian Advisory Group to design the pathway and ensure future railroad options

would not be compromised. For instance, requirements for fencing and barriers separating the two uses, as well as horizontal setback distances needed definition. Guidance was developed outlining these setbacks as a function of train speed, track geometry and other factors. In locations where right-of-way is constricted, the pathway may need to serve as a maintenance pathway for SMART as well.

*Figure 3. Standards were established for offsets between the modes*



## **PARTNERS IN PLANNING**

### **Grass-Roots Support**

Local activists, notably the Marin County Bicycle Coalition had long recognized that a reactivated Cal Park Hill tunnel would provide a valuable transportation amenity and a crucial piece of the planned north-south "greenway" through Marin County. This greenway would offer a new recreational and commuting mode for the many cyclists and pedestrians in the corridor, as well as a fully accessible route for mobility-impaired users such as those confined to wheelchairs.

County supervisors and staff helped channel this lobbying into a proposal to reopen the tunnel for non-motorized use. County staff began a long campaign of applying for grant funding to design and build the project. Initial funding was secured for studying feasibility of the necessary repairs and improvements.

### **Feasibility and Funding**

Late in 2002, County engineers and their consultants completed a feasibility study concluding that the proposed pathway could be constructed and operated, while not precluding future passenger rail service by SMART<sup>2</sup>. By this time the County had crafted a compelling case for



reopening the tunnel for non-motorized use. While planning continued, federal, state and local grant funding was secured piece by piece for design and construction of the necessary repairs and improvements. Table 1 (below) identifies the primary funding sources that have been secured for the project to date.

*Table 1. Funding Sources.*

Source	Amount (Millions)
TEA-21 Funds	\$ 3.0
Bicycle Transportation Account	0.9
Transportation for Livable Communities	1.5
Transportation for Clean Air	0.5
Regional Measure 2 (County)	5.1
Regional Measure 2 (SMART)	11.7
Non-Motorized Pilot Program	2.0
County/Local	0.4
<b>Total</b>	<b>\$25.1</b>

Marin County has been prolific in its enthusiastic support for pedestrian and cycling projects. In 2005 the County was selected as one of four communities nationally to participate in the federal Nonmotorized Transportation Pilot Program (NTPP) under SAFETEA-LU. This program provides \$25 million to each of these four communities between 2006 and 2010, to demonstrate the extent to which bicycling and walking can carry a significant part of the transportation load, and represent a major portion of the transportation solution. The Marin County Department of Public Works is administering the Program locally.

## Role of SMART

SMART's close working relationships with bicycle and pedestrian groups paralleled the planning and design of the Cal Park Hill project. In 2003, SMART formed a Bicycle Pedestrian Advisory Group in order to determine the alignment of a bicycle pedestrian pathway that will follow the SMART corridor.

SMART was an early and active participant in shaping the project. Initially the County had determined that to stay within budget, the project should be built with no lateral separation between the pathway and future commuter railroad, thus requiring the pathway to be relocated to the east side of the right-of-way prior to reestablishing rail service. The SMART Board later determined it would be advantageous to accommodate physical requirements for both the pathway and rail

service during initial construction. This significantly raised the cost of the project, however SMART effectively became an equal funding partner for design and construction of the project from this point forward.

SMART clearly recognized the benefit of the County performing the needed tunnel repairs in advance of rail construction, and also saw this partnership as part of their legislative mandate to provide a continuous pathway in their corridor. In December 2007, the County and SMART entered into a Cooperative Agreement (CA) that allows both agencies to move forward with constructing, operating and maintaining the multi-use pathway and overall corridor. A key premise of the CA is that the County will operate and maintain the pathway up until the time when SMART begins passenger rail service.

## Addressing Stakeholder Concerns

Early on during project planning it was recognized that implementation would be impossible without buy-in by the several affected agencies and stakeholders. The tunnel aspect of the project was unique enough to raise concern in any community. However Marin County has a long history of involvement by residents and environmental groups, as well as public agencies.

To represent stakeholder interests, a Technical Working Group (TWG) was established during Preliminary Engineering, and continued through Final Design. Consisting of County staff and engineers, SMART staff, local public works and transit officials, emergency responders, property owners and other stakeholders, this group convened approximately once per quarter. Their role was to guide development of design criteria, and ascertain that there needs were being addressed throughout the design. Open communication was encouraged and a dialogue established.

Illustrative of the TWG process was the dialogue established with the two cities. The project has roughly equal portions in the cities of San Rafael and Larkspur, and both cities had concerns revolving around operation of the pathway and emergency response procedures.

## Public Outreach

A series of public meetings was established. By design, the public meeting process dovetailed with the TWG process, providing members of the community with an update as to design progress. In addition, members of the public were asked to provide input to decisions regarding

pathway alignment, amenities and operations. One key decision based in part on community input, was location of the pathway, the options being either east or west of the future passenger rail alignment. After reviewing advantages and disadvantages of each, the community strongly favored the east option, which was adopted as the preferred alternative.

Another area of community focus was the location of pathway connections – particularly in Larkspur. Several options were screened at public meetings, resulting in one preferred option being chosen. Screening factors included primary destination of users, availability of right-of-way, pathway safety and security, ADA compliance, impacts to parking and trees, and emergency access.

3D visualizations proved very helpful for demonstrating designer concepts and gaining support, as well as helping describe the as-built project to third parties. “Before and after” conditions at pathway connections were identified, as were design treatments for the tunnel portal, through photorealistic renderings created using computer programs such as Adobe Photoshop and Google Sketchup.

*Figure 4. Approach to “Tunnel Within Tunnel”*



## Regulatory Input

Several regulatory agencies had jurisdictional review responsibilities for project. Environmental impacts were expected to reflect the nature of the corridor’s prior use as a railroad right-of-way. The pathway project was studied as part of SMART’s EIR and later certified by their Board in accordance with CEQA, however with federal funding involved, environmental clearance was also required under the National Environmental Protection Act (NEPA), with delegated authority to Caltrans. To initiate the NEPA environmental local assistance process, Marin

County and Caltrans staff conducted a project site review and agreed upon the necessary environmental technical studies to be carried out. The principal concerns were over potential impacts in the following areas:

- (1) Natural environment (wetlands, biology)
- (2) Historic resources (tunnel, trestle)
- (3) Archaeological resources
- (4) Hazardous materials
- (5) Parking removal near the southern terminus

Studies were conducted in each of these areas and reviewed by Caltrans and other regulatory agencies. Mitigation measures were incorporated into the design plans, such as exclusion of bats from the tunnel during reconstruction. Other mitigation measures were implemented to offset minor losses of seasonal wetlands that had become established in the former railroad ditches, in accord with discussions held with the U.S. Department of Fish & Game. In 2006, Caltrans approved a Categorical Exclusion (CE) on behalf of FHWA, which marked another significant project milestone.

It was anticipated that up to three transportation regulatory agencies would show interest in the railroad aspects of the project, including:

- (1) The California Public Utilities Commission (CPUC), which regulates operational safety of rail in the state;
- (2) The Federal Railroad Administration (FRA), responsible for federal oversight of rail safety standards; and,
- (3) The Surface Transportation Board (STB), which regulates economic activity associated with interstate transport of freight via rail and truck.

Through research and conversations with STB staff, it was learned that formal abandonment within the limits of the Cal Park Hill Project has occurred under prior ownership of the rail corridor, and that present or future owners are under no obligation to resume freight service. As SMART plans to operate only passenger rail service over this portion of the corridor, it is thus not subject to STB regulatory oversight for freight service.

Early meetings with the CPUC outlined their safety concerns. Since this portion of the corridor is designated “out of service”, their concerns revolved around safety in a “shared” environment when rail service is re-introduced. Their feedback centered on the design team’s passenger



rail vehicle dynamic clearance envelope. FRA review or oversight was not required based on the fact that the tracks were out of service.

## TECHNICAL CHALLENGES

### Physical Description and Amenities

The overall project length is approximately 1 mile (MP 14.8 TO MP 15.9), with the tunnel roughly in the center. The pathway is bordered by and generally east of Highway 101, except near the northern end where it crosses underneath the highway overpass to resume on the embankment west of Highway 101. The railroad corridor is generally 100 feet wide.

Outside of the tunnel, the pathway width is generally 12' with a 2' outside shoulder. A barrier/fence separates the future railroad from the pathway. In San Rafael, a 70' prefabricated steel bridge span will be installed next to the single-track wooden railroad trestle over Bellam Blvd, and beneath Highway 101. The new span will blend with the architectural character of the surroundings.

*Figure 5. A new prefabricated bridge will span Bellam Blvd.*



Pathway amenities include landscaping and attractive hardscaping at the trailheads, including signage and historical markers. To enhance the user's experience of transitioning to and from the tunnel, an opaque "tunnel within tunnel" structure will extend 30' from each portal.

### Approach to Tunnel Design

Early on the design team impressed upon County staff the concept of the tunnel as "a living, breathing thing". It was essential that the tunnel environment provide adequate light, drainage, water, ventilation and means of communicating with the outside world. In

addition, the two categories of use (i.e. trains traveling at up to 45 mph, and cyclists/pedestrians) were not mutually compatible. But first, better information about the current tunnel environment was needed.

*Figure 6. Moisture and fire damage had taken a toll on the timber tunnel lining.*



### Gathering Information

The deteriorated condition of the tunnel called not only for innovative design solutions, but also effective means of collecting and parsing data. To maintain critical dimensional clearances between the planned pathway and future trackway, extreme accuracy of measurement was needed. Also, site visits by engineers revealed several small but recent collapses, calling into question the regularity of the tunnel cross section. Earth Tech dispatched its CYRAX<sup>®</sup> laser scanner platform to help develop a 3D model of the tunnel. In less than two days, scans of most of the 1,100' tunnel had rendered a "cloud" of pints with XYZ coordinates, capable of export into CAD and 3D visualization programs.

The resulting CYRAX<sup>®</sup> data is far more accurate and complete than what can be obtained with conventional survey methods. The resulting dataset were heavily relied on by both alignment and geotechnical engineers to assess conditions within the tunnel, and design accordingly.

Figure 7. 3D Laser Scan of Tunnel results in accurate 3D model



### Balancing Competing Space Requirements

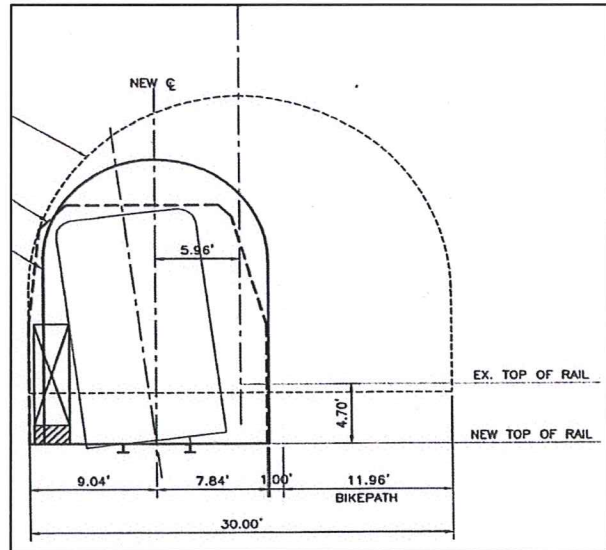
At 30' wide by 24' tall at the crown, the tunnel when built was intended to meet the clearance needs of a double track railroad, but its adequacy to accommodate modern rail equipment plus the pathway was not known. As freight is excluded from this portion of the corridor, the design vehicle used was the Colorado Railcar Bi-level DMU (Diesel Multiple Unit car), versus the larger envelope for a double-stack container freight car.

As preliminary engineering proceeded, it was determined that physical separation was desirable between the "train" side and "pathway" side. To safely separate between the two categories of use, a 2-hour firewall would be provided. The rail side would accommodate future tunnel ventilation equipment (required by NFPA 130 for fire protection), and the pathway side will provide a more modest ventilation system (to evacuate carbon monoxide gas emitted by maintenance vehicles and equipment).

Once established, the rail vehicle dynamic clearance envelope would determine the width left for the pathway. Complicating the design was a roughly 1000' radius curve at the north end of the tunnel. Initially designers established a new, superelevated rail centerline alignment along the west side of the tunnel. The low springline height typical of older tunnels required that the rail profile be lowered by as much as 4' near north portal. Once clear of this "pinch point", the profile could be gradually raised, minimizing the required excavation.

After several iterations and discussion with SMART staff, the alignment was optimized, yielding a clear pathway width of between 11' and 12'.

Figure 8. Dynamic Clearance Envelopes



### Design for Constructability

During Preliminary Engineering the tunnel designer investigated several options for repair and rehabilitation of approximately 950' of the deteriorated or fire-damaged redwood timber liner. Several different methods were reviewed, and two seriously considered:

- (1) Rockbolt/shotcrete liner, which derives structural support with regularly spaced rock bolts drilled 10' to 15' into the tunnel wall. One to two layer of shotcrete would span between the rock bolts to provide support between bolts and prevent rockfall.
- (2) Steel sets/lagging, which establishes a new liner within the existing tunnel, with shotcrete encasement of the structural support system.

The two systems were close contenders in terms of cost and other factors. Fortunately the design was guided by an independent constructability review panel consisting of recognized experts in tunnel design and construction. At key milestones, the panel reviewed the plans, and then met with the design team to share their recommendations.



The constructability review proved quite effective in helping to swing the decision toward the steel set/lagging method. Even with the cost of steel increasing, steel sets were felt to be the most predictable to install, requiring the least disturbance of loose material behind the existing tunnel lining, and thus offered a safer work environment. Any void spaces behind the old liner would be injected with cellular concrete once the new liner was in place.

### ***South Portal Repair***

A 150' section of collapsed tunnel behind the south portal presented further challenges. The constructability review panel was again called upon to opine on the designer's plans for restoring this area. Up to this point, several methods for reconstruction had been explored:

- (1) Excavating the collapse, installing soil nail walls from top to bottom, and leaving an open cut;
- (2) Excavating with temporary shoring, then building and burying a new section of tunnel; and,
- (3) Mining through the debris, installing a new lining in sequence.

Once steel sets had been chosen as the liner replacement, it was decided that the construction contractor could employ this third method, using forepoling with "jump" sets to advance the liner from the north, more stable portion of the tunnel toward the south.

### ***Tunnel Portals/Retaining Walls***

Tunnel portals are often unstable and difficult to keep free of debris. Substantial civil works were required outside the tunnel, both to widen the approach for the pathway and future rail, and to stabilize the steep faces. To retain these cuts, some approaching 30' in height, the designer recommended soil nail walls including a shotcrete facing. Because of the unique and scenic setting of the project and the public's desire for an enhanced user experience, the walls will be given an attractive textured finish after the initial facing has been applied.

Existing embankments did not provide adequate width for both the pathway and the future, realigned commuter rail. Mechanically stabilized earth (MSE) walls were chosen to widen the embankment in these areas, plus at the pedestrian bridge approaches and the future rail station. Designers incorporated construction materials to fit into the environment and compliment the surroundings.

### ***North Portal Collapse***

Physical conditions continued to change even during final design. In the winter of 2005, heavy rains created a new sinkhole and tunnel crown collapse near the north portal, in an area that had required repairs in the recent past. Designers reassessed reconstruction plans for this portion and modified the design accordingly.

### ***Pathway Connections***

#### ***Northern Connection***

There are two public access connections to the pathway, one each at the northern and southern terminus. The northern terminus is near the signalized intersection of Andersen Drive and West Francisco Blvd, in a commercial section of southern San Rafael. A small plaza, trail monument and minimal landscaping will mark the trailhead. The Class I pathway ends here, however existing Class II bicycle lanes along Andersen Drive, can be used by cyclists to access downtown San Rafael and the Bus Transit Center, approximately 1 mile north.

In the future, the trail could be extended to the north and within the railroad right-of-way, which continues north of Andersen Drive. This would provide a more direct, off-street continuation of the bicycle network.

#### ***Southern Connection***

The southern end of the trail is "landlocked" from public streets by private property parcels, thus making the connection to the nearby Ferry Terminal (approximately ¼ mile south) more difficult. Several connection options were investigated during planning and design. Currently the County is negotiating with one property owner, to provide a 300-ft long access easement to Larkspur Landing Circle. From here it is a 10 minute walk to the Larkspur Ferry Terminal, via an existing footbridge over busy Sir Francis Drake Blvd, then a pleasant 30 minute ferry ride to the San Francisco Ferry Terminal Building.

### ***Emergency Access, Safety and Security***

Authorities having jurisdiction (AHJ's) over response to emergencies in the project's vicinity include police and fire departments for both cities. Complicating the division of responsibility is the fact that the tunnel is bisected by the Larkspur/San Rafael city limits. Through the TWG process, a draft emergency response plan was developed,

recommending that a MOU be established clearly outlining roles and responsibilities of the County, SMART and the two cities.

Several design features evolved from the cities' desire to alleviate safety and security concerns, including:

- “Blue light” stations with emergency telephones connected to 911 dispatch.
- Fixed position video cameras connected via the internet to the County and emergency responders;
- Pay telephones;
- Leaky coaxial cable to allow radio and cell phone communications within the tunnel;
- Tunnel lighting;
- A heat detection system inside the tunnel; and,
- Fire hose connections inside and outside the tunnel.

Fire officials were concerned with emergency access to both the north and southern portals. Once determined that the existing timber tunnel lining would be replaced with fireproof shotcrete construction, the concern still remained that emergency vehicle access be provided to handle trash fires, and to address medical emergencies.

The design team worked closely with City staff to provide emergency vehicle clearance and turnaround space outside the southern portal. This required localized widening of the path, and moving the soil nail walls. A “turnaround” space was also provided within 200’ of the portal, and emergency vehicle access routes were designated for both the north and south portals.

### **Safety, Security & Pathway Maintenance**

The tunnel and mid-section of the pathway are somewhat remote, which raised concern over safety and security, particularly during times of low usage. To address the concerns of the community the tunnel portals will be closed for a few hours each night as part of a trial period. After a one year trial period the pathway operators will re-evaluate the hours of operation. Based on the actual safety and security experiences access through the tunnel may remain open for continuous use.

As the interim pathway operator until SMART commences passenger rail operations, the Marin County Parks and Open Space District (MCPOSD) will initially be responsible for opening and closing of the tunnel, as

well as inspection and routine maintenance. Access control will be hastened by use of bollards at pathway entrances, lockable gates, fencing and signage at appropriate locations. City police departments will also patrol their segments of the pathway.

### **CONCLUSION & LESSONS LEARNED**

The implementation of any unique and capital-intensive project is challenging. But with growing momentum for sustainable, context-sensitive projects, even a diverse population can be brought on board through appropriate outreach and forthright discussion. Also, knowing the nuances of all regulatory agencies is essential.

By their nature rails with trails involve multiple jurisdictions. It is critical for all affected parties to cooperatively participate and embrace the decision process during project development in order to achieve success. Early assessment of win-win strategies can save time and money during the initial capital investment and during the long term operations of the facility.

From a design standpoint, implementation of any rails-with-trails project should be tempered with staff or consultants professionally familiar with design and operational characteristics of the railroad environment. For a tunnel project, which is by nature highly complex, a built-in “checks and balances” system of assessing design progress (i.e. ongoing constructability review) is highly prudent. And with the availability of increasingly better 3D modeling tools, it behooves any complex project to produce quick 3D renderings which can “sell” decision makers on merits of project features.

A wealth of excellent information is coming online as “pathway partnerships” are put in place, such as that which gave form to the Cal Park Hill Tunnel Pathway. As a result, green, sustainable projects are breaking ground on a more and more frequent basis. Hopefully the County of Marin’s experience will prove useful for other agencies considering rail-with-trail projects.

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<sup>1</sup> *Cal Park Hill Tunnel Rehabilitation and Pathway Design Project – Historical Resources Inventory and Evaluation Report*, February 2004 (Earth Tech, URS Corporation, County of Marin)

<sup>2</sup> *Cal Park Hill Tunnel and Bicycle/Pedestrian Pathway Study Final Report*, December 2002. (Nelson\Nygaard Consulting Associates, Parisi Associates, County of Marin)